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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/798,456	03/10/2004	Youngjin Choi	LAM1P187/P1216	6110
22434	7590	03/10/2006	EXAMINER	
BEYER WEAVER & THOMAS LLP P.O. BOX 70250 OAKLAND, CA 94612-0250			UMEZ ERONINI, LYNETTE T	
			ART UNIT	PAPER NUMBER

1765

DATE MAILED: 03/10/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/798,456	CHOI ET AL.	
	Examiner	Art Unit	
	Lynette T. Umez-Eronini	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 3/10/04.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 16 and 17 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 and 18-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 16 and 17 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>8/9/2004</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-15 and 18-20, drawn to an etching method, classified in class 438, subclass 706.
 - II. Claims 16, drawn to a device formed by a method of etching, classified in class 438, subclass 1⁺.
 - III. Claim 17, drawn to an apparatus, which is used in an etching method, classified in class 156, subclass 345.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make another and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product as claimed can be made by another and materially different process such as one that does not requires etching with a gas.
3. Inventions I and III are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another and materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the process as claimed can be practiced by another and

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materially different apparatus or by hand such as an apparatus that lacks a computer readable media for performing an etching method.

4. Inventions III and II are related as apparatus and product made. The inventions in this relationship are distinct if either or both of the following can be shown: (1) that the apparatus as claimed is not an obvious apparatus for making the product and the apparatus can be used for making a materially different product or (2) that the product as claimed can be made by another and materially different apparatus (MPEP § 806.05(g)). In this case that the product as claimed can be made by another and materially different apparatus such as one that does not requires a computer readable media.

5. Because these inventions are independent or distinct for the reasons given above and have acquired a separate status in the art in view of their different classification, restriction for examination purposes as indicated is proper.

6. Because these inventions are independent or distinct for the reasons given above and the inventions require a different field of search (see MPEP § 808.02), restriction for examination purposes as indicated is proper.

7. During a telephone conversation with Michael Lee on 2/13/2006 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-15 and 18-20. Affirmation of this election must be made by applicant in replying to this Office action. Claims 16-17 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

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8. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Information Disclosure Statement

9. The information disclosure statement filed 8/9/2004 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

Claim Rejections - 35 USC § 112

10. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

11. Claims 6-8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 6, lines 1-2, "the seed silicon layer"; and

In claim 7, "the stack;" lacks antecedent basis.

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

13. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

14. Claims 1, 2, 4-7, 13, 14, and 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Naeem et al. (US 5,846,884 in view of Hineman et al. (US 6,379,872 B1).

Naeem discloses a method for etching through a selected portion of a layer stack (Abstract), which comprises interlayer dielectric layer **102**, barrier layer **104**, metallization layer **106**, barrier layers **108 and 110**, anti-reflective coating layer **112**, and photoresist layer **114**. The ARC layer **112** may be organic in nature (column 1, lines 20-57). Naeem also discloses, "In step **302**, etching is preformed . . . using . . . gases such

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as N₂, . . . O₂, CHF₃, CF₄, CO and/or other suitable chemistry (column 6, lines 13). The aforementioned reads on,

A method for etching a layer through a photoresist mask with an ARC layer between the layer to be etched and the photoresist mask over a substrate, comprising:

placing the substrate into a processing chamber;

providing an ARC open gas mixture into the processing chamber, wherein the ARC open gas mixture comprises:

an etchant gas; and

a polymerization gas comprising CO and CH₃F;

forming an ARC open plasma from the ARC open gas mixture; etching the ARC layer with the ARC open plasma until the ARC layer is opened, **in claim 1**;

A method for forming a semiconductor device, comprising:

placing a layer to be etched over a substrate; forming an organic ARC layer over the layer to be etched; forming a photoresist mask over the ARC layer;

placing the substrate into a processing chamber;

providing an ARC open gas mixture into the processing chamber, wherein the ARC open gas mixture comprises:

an etchant gas; and

a polymerization gas comprising CO and CH₃F;

forming an ARC open plasma from the ARC open gas mixture;

etching the ARC layer with the ARC open plasma until the ARC layer is opened;

providing an etch plasma different than the ARC open plasma; and

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etching the layer to be etched with the etch plasma, **in claim 18**;

wherein the ARC open gas mixture further comprises an etch rate booster, wherein the etch rate booster is O₂, **in claims 4 and 19**;

wherein the layer to be etched is a dielectric layer and wherein the etchant gas comprises at least one of an N₂ and H₂ mixture and CF₄, **in claim 5 and 20**; and

further comprising providing a photoresist mask over the stack, **in claim 7**.

Naeem differs in failing to teach stopping the ARC open gas mixture before the layer to be etched is completely etched, **in claim 1**; and stopping the ARC open gas mixture, so that none of the layer to be etched is etched by the ARC open plasma, **in claim 18**.

Hineman teaches, "To provide a more uniform and predictable etch through the ARC **14**, two plasma etching processes are performed sequentially. . . the first plasma etch process should be halted before etching of the ARC **14** is completed. . . In general it is desirable to use the first plasma etch to etch as much of the ARC **14** as possible, but to stop the first plasma etch process prior to any etching of the (underlying layer) layer **12**" (column 3, lines 26-54).

Hineman illustrates stopping an ARC open gas mixture before the layer to be etched is completely etched, is known. Hence, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Naeem by stopping the etching of an ARC open gas mixture for the purpose of uniformly etching through an ARC (Hineman, column 3, lines 26-27).

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Since the combination of Naeem and Hineman teaches a similar method of etching the same materials as applicants, then using the said combination in the same manner as claimed by applicants would result the same wherein ARC open plasma highly selectively etches the ARC with respect to the layer to be etched, **as in claim 2.**

15. Claims 3 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Naeem (US '884) in view of Hineman (US '872 B1) as applied to claim 1 above, and further in view of Chen et al. (US 6,080,662).

Naeem in view of Hineman differ in failing to disclose wherein the flow rate of CO is at least 150 sccm, **in claims 3 and 12.**

Chen discloses, an etching process that uses 0-200 sccm of CO (Abstract).

Chen illustrates CO having a flow rate of at least 150 sccm is known. Hence, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Naeem by selecting any flow rate of CO as taught in the Chen reference, including applicants' claimed flow rate, which would effectively accomplish the disclosed composition in an etching method because it has been held that there is no invention where the difference in proportions is not critical and was ascertained by routine experimentation because the determination of workable ranges is not considered inventive. See *In re Swain and Adams*, 70 USPQ 412 (CPA 1946).

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16. Claim 8 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Naeem (US '884) in view of Hineman (US '872 B1) as applied to claim 1 above, and further in view of Angelopoulos et al. (US 6,316,167 B1).

Naeem in view of Hineman differ in failing to teach wherein the ARC layer is of an organic material and wherein the photoresist mask is of a 193 or higher generation photoresist, **in claim 8**; and wherein the ARC layer is of an organic material and wherein the photoresist mask is of a 193 or higher generation photoresist and wherein the ARC open plasma etches the ARC with respect to the layer to be etched with a selectivity greater than 50:1, **in claim 10**.

Angelopoulos discloses, "A broad aspect of the present invention is a resist structure comprising a resist on top of a vapor deposited RCHX film. . . wherein the optical and chemical properties of the RCHX films are tuned to (1) provide suitable optical properties at the appropriate wavelength (248 nm, 193 nm, 157 nm, 126 nm and extreme ultraviolet radiation) to function as an ARC (2) not negatively interact with the resist inducing residue, footing or undercutting and (3) provides good etch selectivity to the resist." (column 5, line 66 – column 6, line 10).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Naeem in view of Hineman by using a photoresist mask of 193 or higher generation photoresist for the purpose of providing good etch selectivity to the resist (Angelopoulos, column 6, line 5-10).

Since the combination of Naeem in view of Hineman and further in view of Angelopoulos teaches a similar method of etching as claimed by applicants, then using the said combination in the same manner as the claimed invention would result the same wherein the ARC open plasma etches the ARC with respect to the layer to be etched with a selectivity greater than 50:1.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 571-272-1470. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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February 28, 2006

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER
